



A STATEWIDE UTILITY PROGRAM

2019 Title 24 Codes & Standards Enhancement (CASE) Proposal

High Performance Walls

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Proposed Code Change Overview

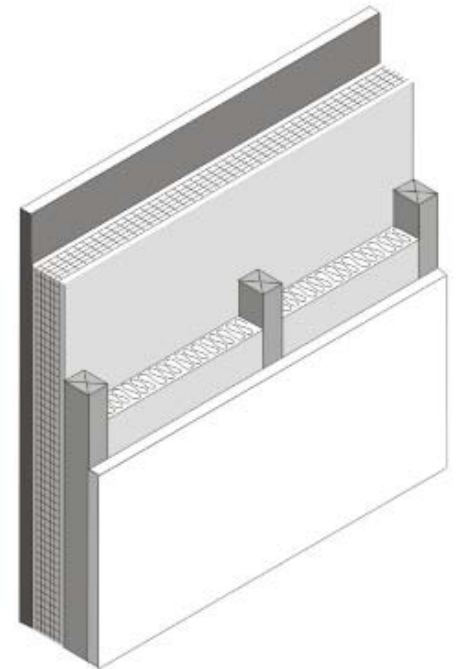
- Types of building impacted
 - Single-family and low-rise multi-family residential
- Building system impacted
 - Exterior walls
- Anticipated type of change
 - Prescriptive
- Description of change
 - Lower prescriptive wall U-value in climates where it's cost-effective

Proposed Code Change History

- Why are we proposing this measure?
 - 2016 CASE work found HPW to be cost-effective in all climates except 6/7
 - Support CA climate action goals and move towards ZNE buildings
 - Support cost-effective envelope improvement opportunities prior to introducing PV
 - Level of construction industry comfort with HPW expected to increase through 2016 code cycle

Current Code Requirements

- 2016 Title 24 Requirements
 - High Performance Wall in 2013 code = 0.051 U-value
 - 2x6 R-19 + R-5 rigid
 - 2x6 R-21 + R-4 rigid
 - *Except CZ 6/7 = 2x4 R-15 + R-4 rigid*
- Existing National Code Requirements
 - 2015 IECC
 - Most of state: 2x4 R-13 + R-5
 - CZ 15: 2x4 R-13
 - CZ 16: 2x6 R-20 + R-5



Typical Practices

- Current practices
 - 2x4 wall w/ 1” foam (typically EPS) & 1-coat stucco
 - Common in Northern CA
 - 2x6 wall w/ no foam
 - More common in MF
- Trends
 - Use of 2x6 walls increasing in advanced homes
 - Expect some level of market shift with 2016 code
 - PV credit & other measures will still be used to offset HPW & HPA
 - **PV credit going away with 2019 code**

Do you agree with this description?

Market Overview and Analysis

- Current Market
 - Strategies are mature, but practice not pervasive throughout CA new homes
 - Various market transformation activities underway
 - WISE (<http://www.wisewarehouse.org/>)
 - Utility outreach
 - CAHP incentives for early adopters
 - Introduction of new products & new strategies
- Market barriers
 - Building industry coming up to speed
 - Familiarization with implementation

Other market information sources to note?

Incremental Cost Estimation – Preliminary

- How we are collecting costs of base case technology and proposed technology
 - Big Box store product survey (insulation products)
 - Discussions with manufacturers & distributors
 - Previous CASE reports & other studies
 - Builder projects
 - WISE

Incremental Cost Estimation – Preliminary

- Preliminary incremental costs:
 - Costs below includes 30% mark-up

Rigid Insulation

- \$0.29/ft.² EPS
- \$0.57/ft.² XPS/GPS
- \$0.64/ft.² Polyiso

Cavity Insulation

- \$0.22/ft.² R-21 vs R-15

Window Framing/Flashing

- \$1.16 / linear ft. 1” foam
- \$1.34 / linear ft. 1.5” foam
- \$1.50 / linear ft. 2” foam
- \$1.67 / linear ft. 2.5” foam

Wall Framing

- \$0.19/ft.² 2x6 vs 2x4

Methodology for Savings Analysis

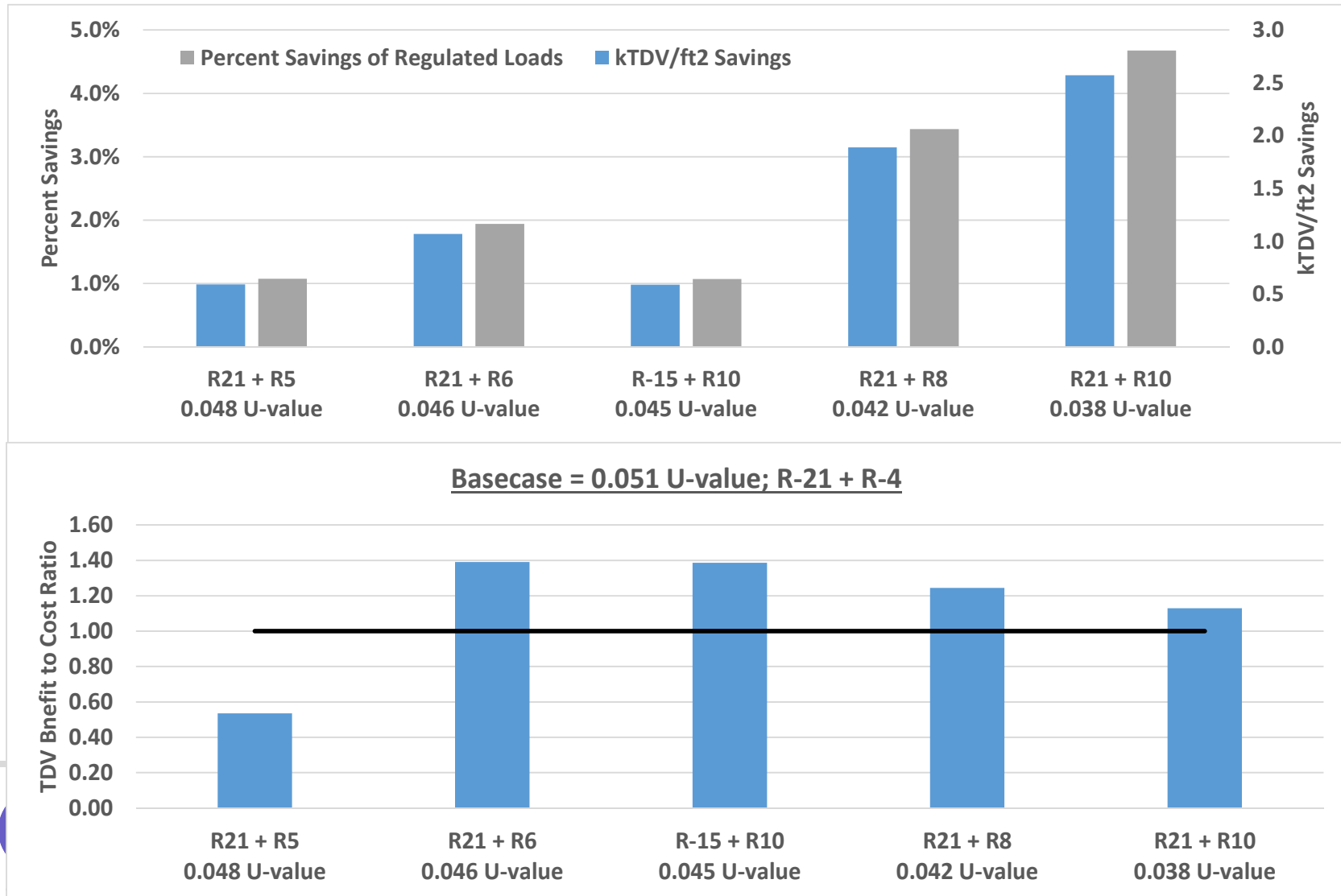
- Methodology for energy and demand impacts
 - 2016 CBECC-Res compliance software using 2019 TDV
 - Applied CEC prototype buildings
 - Single family: 2,100 ft.² 1-story and 2,700 ft.² 2-story
 - Results presented as blended average of 45% 1-story & 55% 2-story
 - Multi-family: 6,960 ft.², 8 unit, 2-story building
 - Evaluated various levels of increased wall insulation
 - Excluded CZ 6 & 7 from the analysis
 - Base case = 2016 prescriptive requirements of 0.051 U-value wall
 - Used R-21 + R-4 wall as reference since EPS is the typical exterior insulation choice

Incremental Cost Savings

- Approach
 - Incremental cost savings are calculated based on TDV cost savings associated with energy savings over the entire 30-yr period of analysis.
 - Net Present Value of savings based on 2019 TDV cost multiplier of \$0.1732/TDV kBTU saved.
 - Benefit to Cost ratio = NPV TDV cost savings / lifecycle cost
 - No replacement or maintenance costs associated with this measure

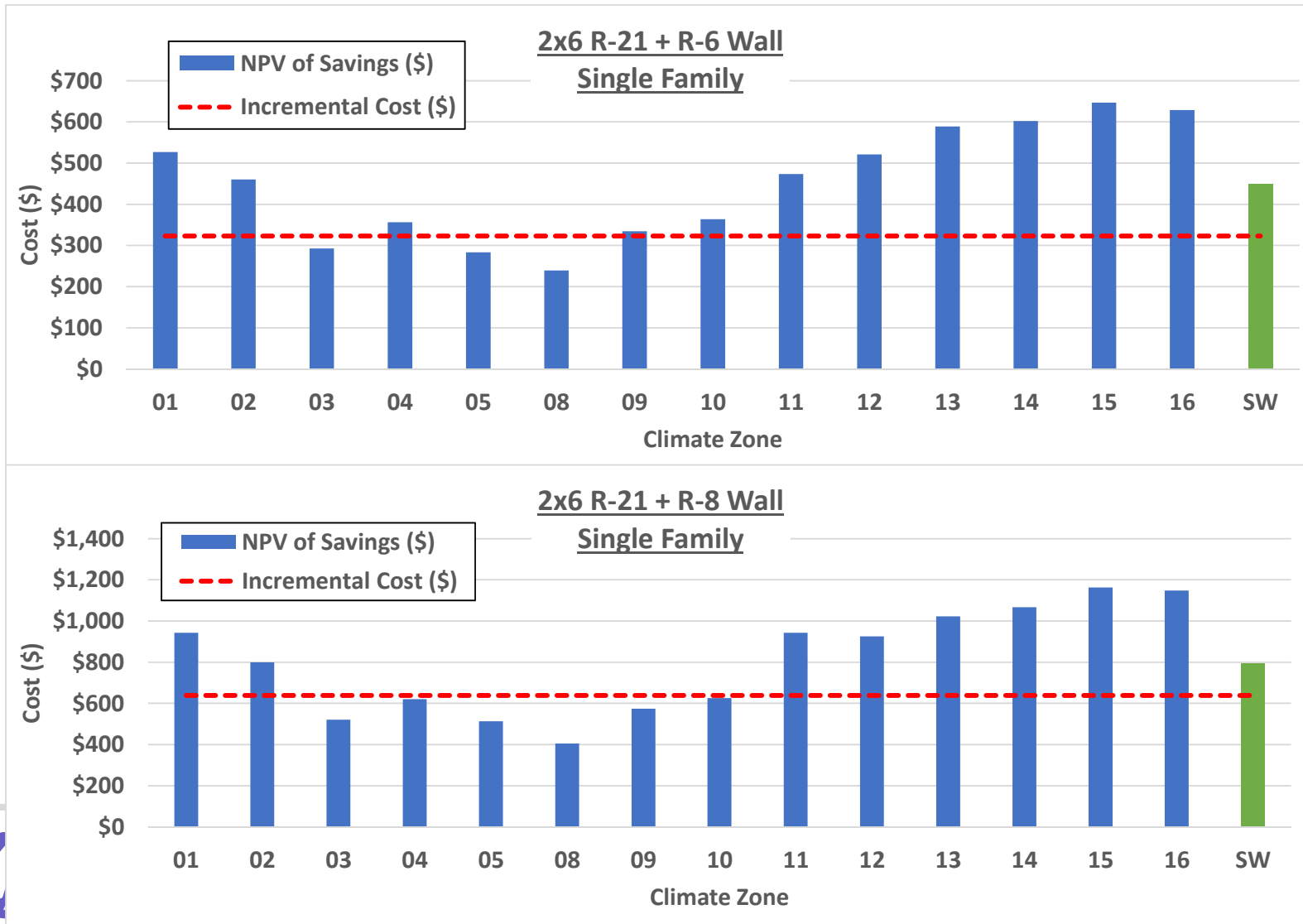
Initial Data and Findings – Single-Family Energy Savings Comparison

- Statewide weighted averages, less CZ 6 & 7.



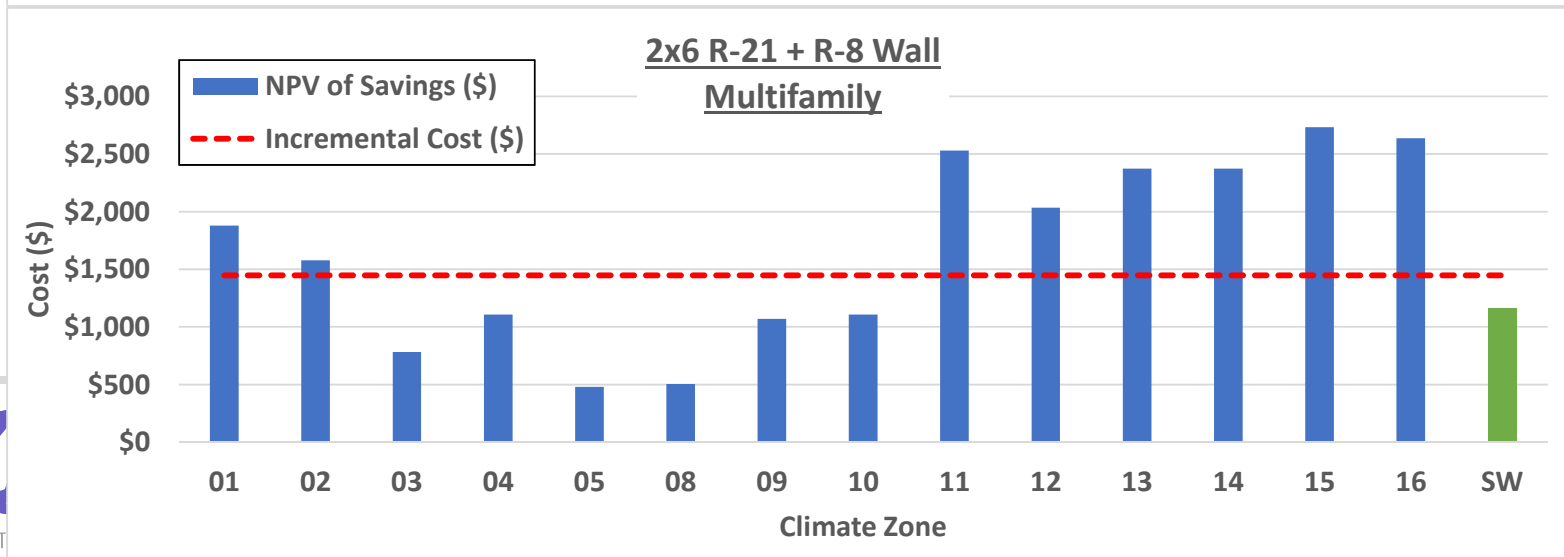
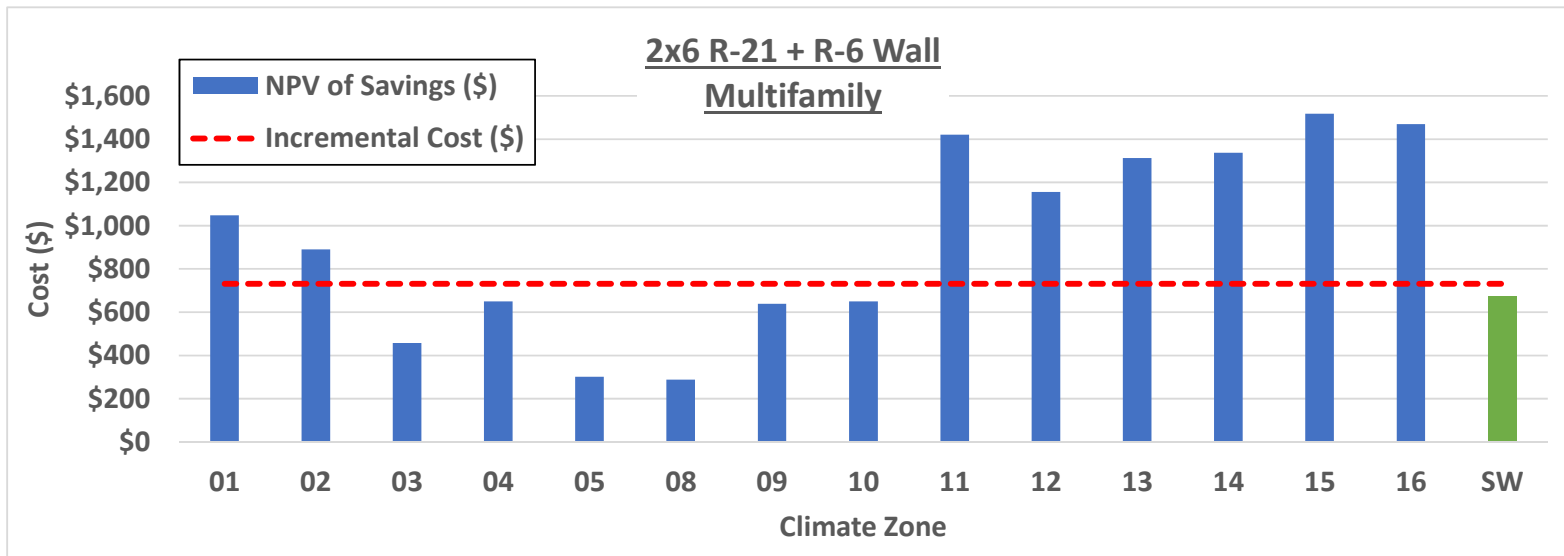
Initial Data and Findings – Single-Family Cost Effectiveness

*Cost effective in hot/cold climates, not mild.



Initial Data and Findings – Multi-family Cost-Effectiveness

*Cost effective in hot/cold climates, not mild.



Preliminary Energy Impacts – Statewide Weighted (Less CZ 6/7)

Preliminary Energy Savings Estimate						
		Annual per Unit Electricity Savings* (kWh/bldg-yr)	Annual per Unit Natural Gas Savings* (Therms/bldg-yr)	First Year Statewide Electricity Savings (GWh/yr)	First Year Statewide Natural Gas Savings (Million Therms/yr)	Confidence Level (high, medium, low)
Single Family	R21 + R6	20	6	1.9	0.6	High
	R21 + R8	36	11	3.5	1.1	High
Multifamily	R21 + R6	16	8	0.05	0.02	High
	R21 + R8	30	15	0.09	0.04	High

*Per building savings based on the CEC prototypes

2,430 ft.² single family building

8-unit, 2-story MF building

*Based on 2016 construction starts – to be updated for 2019

Preliminary Cost Effectiveness Estimates – Single-Family Statewide Weighted (Less CZ 6/7)

R-21 + R-6	Benefit (2020\$)	Cost (2020\$)
Total Per Unit Incremental Cost over Period of Analysis		
• <i>Incremental first cost - rigid insulation</i>		• \$233
• <i>Incremental first cost –window framing/flashing</i>		• \$90
• <i>Incremental maintenance cost (replacement equipment, regular maintenance) over period of analysis</i>		• (\$0)
Per Unit TDV Cost Savings over Period of Analysis	\$449	
TOTAL	\$449	\$323
Benefit/Cost Ratio		1.39

R-21 + R-8	Benefit (2020\$)	Cost (2020\$)
Total Per Unit Incremental Cost over Period of Analysis		
• <i>Incremental first cost - rigid insulation</i>		• \$466
• <i>Incremental first cost –window framing/flashing</i>		• \$172
• <i>Incremental maintenance cost (replacement equipment, regular maintenance) over period of analysis</i>		• (\$0)
Per Unit TDV Cost Savings over Period of Analysis	\$794	
TOTAL	\$794	\$638
Benefit/Cost Ratio		1.24

Compliance and Enforcement – Market Actors

- Who would be involved in implementing this measure?
 - Architect/designer
 - T-24 consultant
 - Owner
 - Builder
 - Subcontractors (framer, window installer, stucco contractor)
 - Plans examiner / building inspector
- *Others?*

Compliance and Enforcement – Tasks

Market Actor	Task(s)	Success Criteria
Architect/Designer	<ul style="list-style-type: none"> - Product specification - Develop building details & sections 	<ul style="list-style-type: none"> - Balances form/function to satisfy owner desires - Documentation prepared for permit submittal with minimal clarifications - Meet project budgets
Title-24 Consultant	<ul style="list-style-type: none"> - Provide feedback on the impact of energy measures on compliance - Ensure builder is aware of code requirements - Complete forms & upload to HERS registry 	<ul style="list-style-type: none"> - Project team is aware of requirements with no surprises - Energy goals are met - Minimal plan check comments
Owner	<ul style="list-style-type: none"> - Develop project goals including programming, schedules, & budget - Little direct involvement 	<ul style="list-style-type: none"> - Project completed to expected standards and within budget / schedule

What are we not capturing?

Compliance and Enforcement – Tasks

Market Actor	Task(s)	Success Criteria
Builder	<ul style="list-style-type: none"> - Coordinate with design team & trades - Ensure trades are aware of all requirements - Ensure proper product installation - Schedule inspections & post forms onsite 	<ul style="list-style-type: none"> - Meet project budgets & schedule - Minimal inspection failures - Minimal paperwork required - Owner satisfied and no warranty issues
Subcontractors (framer, stucco contractor, window installer)	<ul style="list-style-type: none"> - Install product to meet requirements - Ensure air barrier and flashing around window is installed properly 	<ul style="list-style-type: none"> - Meet builder's schedule - Finish within budget - Minimal inspection failures - Minimal paperwork required
Plans Examiner	<ul style="list-style-type: none"> - Verify that CF-1R is consistent with building plans and meets compliance criteria for local jurisdiction 	<ul style="list-style-type: none"> - Minimize amount of paperwork needed to review
Building Inspector	<ul style="list-style-type: none"> - Verify code requirements are met - Verify that paperwork is complete & CF forms are signed and certified - Sign occupancy permit 	<ul style="list-style-type: none"> - Issue permit with minimal re-inspections - Minimal paperwork

What are we not capturing?

Compliance and Enforcement – Resources

Market Actor	Resource(s)
Architect/Designer	- T-24 consultant
Title-24 Consultant	- CBECC-Res compliance software - T-24 standards & associated docs - Energy Code Ace tools - CEC hotline
Builder	- Building officials - T-24 consultant - HERS rater - Subcontractors - Industry training classes
Subcontractors	- Industry training classes - HERS rater - Builder
Plans Examiner / Building Inspector	- Energy Code Ace tools - T-24 standards & associated docs
Owner	- Project team members

Are we missing any resources or tools?

Strawman Code Change Language

- Title 24 Standards
 - Revise Table 150.1-A prescriptive tables
 - Update Section 150.1(c)1B
- Title 24 Appendices (JA, RA, or NA)
 - No changes
- Alternative Compliance Method (ACM) Technical Manual
 - Update '*Exterior Walls*' section to reflect Table 150.1-A for the standard design
- Applies to new construction & additions – existing exclusions for additions would remain

Request from Stakeholders

- *We would like your input*
 - Builder/construction industry feedback on implementing HPA strategies
 - Cost information on alternative HPA strategies
 - Identifying barriers to implementation
- Please provide input to
 - CASE author or to Title24Stakeholders.com

Thank you.

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